Environmental toxin exposure, generalized anxiety, and perceived health symptoms

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Abstract

The relationships among exposure level, generalized anxiety, and perceived health symptoms in adults environmentally exposed to manganese. A moderator analysis showed that exposure moderates the relationship between anxiety and perceived health symptoms. While there was no main effect of exposure on perceived health symptoms, anxiety impacted perceived health symptoms differently for individuals with high exposure compared to individuals with low exposure.

Introduction

• Mn is a naturally-occurring element that is essential for normal functioning and is found in the body in small amounts (ATSDR, 2000).

• Mn is toxic in large doses, and overexposure is associated with mood symptoms (Bowler et al., 2007) and adverse physical health consequences (ATSDR, 2000).

• Linear dose-effect relationships between Mn exposure and mood symptoms (Bowler et al., 2007; Bowler et al., 2012) have been documented, indicating that more exposure results in more severe symptoms.

• Anxiety has been shown to impact an individual's perception of his or her physical health (Howren & Suls, 2011).

• Hypothesis 1: Greater Mn exposure is associated with a larger number of perceived health symptoms in this sample.

• Hypothesis 2: Anxiety is associated with a greater number of perceived health symptoms in this sample.

• Hypothesis 3: Mn exposure moderates the relationship between anxiety and perceived health symptoms in this sample

Methods

Overall Study Design

This study analyzed archival data collected from two Ohio, USA towns with previously identified high levels of airborne Mn from industrial pollution (Marietta and East Liverpool) as part of a large-scale EPA-funded cross-sectional strict epidemiological study on the health implications of environmental Mn exposure in adult residents living near an Mn source (Bowler et al., 2011).

Participants

Inclusion Criteria
• Received a recruitment letter (up to 2 members/ household)
• 30 - 74 years old
• At least 10 years residency
• Residing up to 2 air miles W/NW from point source (East Liverpool only)
• Reside in 45750 zip code (Marietta only)

Exclusion Criteria
• Pregnant or breastfeeding
• Occupational exposure to pesticides, fungicides, CO, or heavy metals requiring a doctor's visit
• Psychiatric, neurological, or hepatic medical diagnosis
• Treatment for alcohol or drug dependence
• Head injury or stroke: hospitalization > 1 day
• Previous or current employment at Mn source plant
• Having lived in Marietta (East Liverpool only) or East Liverpool (Marietta only)

Sample Characteristics
• Randomly selected from households meeting location and duration of residency criteria
• **Marietta:** 45 men, 55 women, aged 30-74; **East Liverpool:** 31 men, 55 women, aged 30-70

Measures

Mn exposure: distance in air-miles from the Mn source; shorter distance indicates higher Mn exposure (M=3.08; SD=2.2)

Anxiety: symptoms were measured using the computed SCL90-R score of the generalized anxiety syndrome described by Bowler and colleagues (2012) (M=52.95, SD=8.33).

Perceived health: symptoms were measured as the total number of symptoms out of 72 endorsed on a Health Study Questionnaire (M=14.45, SD=11.24).

Data Analysis

A moderator analysis was used to examine the relationship between Mn exposure, anxiety and perceived health symptoms. The Mn exposure and anxiety variables were centered prior to being entered into the model in order to address possible issues with multicolliniarity. The centered Mn exposure and anxiety variables were entered at step one of the model, and an interaction term was entered at step two. In order to examine the interaction effect, the relationship between Mn exposure and perceived health symptoms was plotted for high, medium, and low values of the moderator variable (one SD above the mean, mean, and one SD below the mean, respectively).

Results

Hypothesis 1: Exposure did not uniquely predict number of perceived health symptoms (b=.205, t=.547, p>.05)

Hypothesis 2: A main effect for anxiety symptoms was detected (b=.803, t=8.379, p<.001).

Hypothesis 3: Exposure moderated the relationship between anxiety and health symptoms (b=.136, t=2.721, p<.001)

• The model accounted for 37% of the variance in perceived health symptoms (R^2=.336, p<.01).

Predicting perceived health symtoms with generalized anxiety symptoms and Mn exposure
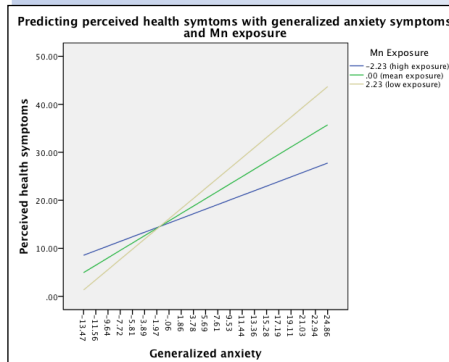
• Participants with higher exposure and higher anxiety reported more health symptoms than those with higher exposure and lower anxiety; but for those participants with lower exposure, those with higher anxiety reported more health symptoms than those lower anxiety.

Conclusions

These findings suggest that, because anxiety may have a greater impact on health symptoms at low Mn exposure than at high exposure , these two variables work in concert to influence an individual's perception of mental and physical health symptoms reported.